REMARKS

Claims 1-27, 34 and 35 are pending in this application. Claims 28-33 have been canceled as being drawn to a non-elected invention. All pending claims have been rejected under 35 U.S.C. § 103. Claims 1 and 23 have been amended to recite that the CDO film is formed by contacting the substrate with a CDO precursor containing a carbon-carbon triple bond, the formed film contains carbon-carbon triple bonds and has a dielectric constant of less than about 2.7. Claim 34 has been added, directed toward forming a CDO film having a dielectric constant of at most 2.7 using a precursor selected from: bis(alkylsilyl) acetylenes, bis(alkylsilyl) ethylenes, and siloxanes having pendant hydrocarbon groups with a carbon-carbon triple bond or double bond. Claim 35 has been added, directed toward using a single precursor containing an alkenyl or alkynyl group to form a CDO film having a dielectric constant of less than about 2.7.

These claims are supported throughout the specification. No new matter has been added.

35 U.S.C. § 103 Rejections

The pending claims have been rejected under 35 U.S.C. § 103 as being unpatentable over Xia et al., U.S. Patent No. 6,258,735 ("Xia") and as being unpatentable over U.S. Patent No. 6,797,643 to Rocha-Alvarez et al. ("Rocha-Alvarez").

Claims 1 and 23

Applicants have amended claim 1 to recite that the film is contacted with at least one precursor having carbon-carbon triple bonds, under process conditions whereby the film formed contains carbon-carbon triple bonds. This feature is not taught or suggested by either of the cited references.

Using conventional Si containing organics as precursors in a conventional plasma enhanced chemical vapor deposition (PECVD) process typically results in a CDO film having a dielectric constant of 2.7-2.95 (see paragraph 0005 of US Application No. 10/789,103 incorporated by reference in the present application). Incorporating C=C bonds into the film alters the matrix structure increases the nanometer scale pore space in the CDO matrix resulting in a reduction of the solid's dielectric constant. See, e.g., the discussion at paragraph 0024. As shown in Examples 1-4, use of ETMS and BTMSA (precursors having carbon-carbon triple

bonds), resulted in k-values of less than 2.7. Applicants have shown that incorporating triple bonds into the film results in a reduction of k-value.

Xia relates to deposition of CDO films having dielectric constants of 3.0 or less using organosilicon compound precursors. Xia does not teach or suggest using a precursor having a carbon-carbon triple bond. The only precursors listed in Xia that have any degree of unsaturation are four precursors containing phenyl groups (col. 3, lines 6-10). There is no teaching or suggestion that unsaturated precursors would have any advantage over saturated precursors, or of using a precursor having a specifically a carbon-carbon triple bond. Further, there is no teaching or suggestion that the dielectric films would have dielectric constant of less than 2.7. As noted above, conventional organic precursors result in k-values between 2.7 and 3.0.

Rocha-Alvarez relates to deposition of CDO films using cyclic organosilicon compounds that are blended with various aliphatic compounds. As noted by the Examiner, Rocha-Alvarez does not specifically teach a CDO precursor having a carbon-carbon triple bond. The Examiner contends that it would have been obvious to utilize the combination of an aliphatic compound as taught in Rocha-Alvarez with a carbon-carbon triple bond with an expectation of success.

Applicants submit that claim 1 is patentable over Rocha-Alvarez at least because using a precursor containing a triple bond results in a CDO film that has unexpected and non-obvious properties, specifically a reduction of k-value. There is no teaching or suggestion in Rocha-Alvarez that using a precursor containing a carbon-carbon triple bond would have any advantage over the precursors listed in the reference.

Further, claim 1 requires that the carbon-carbon triple bonds be incorporated into the film. Nothing in Rocha-Alvarez teaches or suggests that the unsaturated groups in the precursors are incorporated into the film, as required by Applicants' claims. Reaction conditions may lead to consumption of the reactive C≡C bonds during deposition. Absent some suggestion that it is important to preserve these bonds, it would not be obvious to one of skill to incorporate them into the CDO film or that they would be incorporated into the films of Rocha-Alvarez.

For at least these reasons, Applicants submit that claim 1 is patentable over the cited art. Independent claim 23 is also patentable for at least these reasons, as are dependent claims 2-22 and 24-27.

In addition to the reasons given above for claims 1 and 23, independently patentable features of various dependent claims are discussed below:

Claims 8 and 11

Claim 8 requires forming a CDO film having carbon-carbon triple bonds on a substrate by contacting the substrate with a single CDO precursor containing carbon-carbon triple bonds. As explained in Applicant's specification, the single precursor provides all the necessary oxygen, silicon, and carbon, including the carbon-carbon triple bonds (paragraph 0098). This is not taught or suggested by the cited references.

The CDO films of Rocha-Alvarez are formed by blending cyclic organosilicon precursors with the aliphatic precursors listed in col. 3. There is no teaching or suggestion of using a single precursor containing carbon-carbon triple bonds to form a film containing carbon-carbon triple bonds. As indicated above, Xia does not teach or suggest using precursors containing carbon-carbon triple bonds.

Claim 11, which depends from claim 8, specifies that the single precursor is selected from silanes having at least one hydrocarbon group with a triple bond and at least one alkyl group and bis(alkylsilyl)acetylenes. As noted above, the only unsaturated precursors mentioned in Xia are phenyl-containing precursors. Rocha-Alvarez discloses one unsaturated precursor, vinylmethylsilane (col. 3, line 44). Neither reference teaches or suggests using either a silane having at least one hydrocarbon group with a triple bond and at least one alkyl group or a bis(alkylsilyl)acetylene as a single CDO precursor.

Claims 12 and 26

Claims 12 and 26 recites specific precursors having carbon-carbon triple bonds. In rejecting these claims, the Examiner contends that because Xia and Rocha-Alvarez disclose a variety of organosilicon compounds and that many compounds are interchangeable, it would have been obvious to utilize the claimed compounds with the expectation of obtaining similar results. Applicants respectfully disagree. As described above, the claimed precursors are not interchangeable with the organosilicon compounds disclosed in Xia and Rocha-Alvarez. Rather, the claimed compounds result in an incorporation of carbon-carbon triple bonds in the film, thereby reducing the dielectric constant.

Claim 34

New independent claim 34 recites bis(alkylsilyl) acetylenes, bis(alkylsilyl) ethylenes, and siloxanes having pendant hydrocarbon groups with a carbon-carbon triple bond or double bond. As discussed in Applicants' specification, these are specific classes of precursors that contain special functional groups that during deposition become integrated in the CDO film on the substrate, reducing dielectric constant and lowering tensile stress.

Neither Xia nor Rocha-Alvarez teach or suggest these particular precursors. As noted above, the only unsaturated precursors mentioned in Xia are phenyl-containing precursors. Nowhere are bis(alkylsilyl) acetylenes, bis(alkylsilyl) ethylenes, or siloxane groups having pendant unsaturated hydrocarbon groups taught or suggested. Rocha-Alvarez discloses one unsaturated precursor, vinylmethylsilane (col. 3, line 44). Nowhere are bis(alkylsilyl) acetylenes, bis(alkylsilyl) ethylenes, or siloxane groups having pendant unsaturated hydrocarbon groups taught or suggested.

Claim 35

New claim 35 recites forming a CDO film having a dielectric constant of less than about 2.7 using a single precursor containing an alkenyl and alkynyl group. This aspect of the invention allows a CDO film with incorporated carbon-carbon triple and double bonds, and their derivative bonds to be formed using a single precursor.

Applicants submit that this claim 35 is patentable over the cited references. As discussed above, Xia does not teach or suggest using a precursor containing an alkenyl or alkynyl group or a CDO film having a dielectric constant of less than about 2.7. As indicated above, Rocha-Alvarez discloses one precursor with an alkenyl group (vinylmethylsilane); however Rocha-Alvarez teaches that this precursor is blended with at least one cyclic organosilicon compounds (col. 2, lines 41-50). Nowhere does Rocha-Alvarez teach or suggest using a single precursor having an alkenyl or alkynyl group.

Double Patenting

Claims 1-27 have been provisionally rejected on the ground of nonstatutory obviousness-type double patenting over claims 1-33 of copending application No. 10/789,103 and over claims 1-32 of copending application No. 10/820,525. Applicants propose to file terminal disclaimers when and if any of these claims are otherwise indicated allowable.

Conclusion

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at the telephone number set out below.

Respectfully submitted,
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